

## CLAIMS

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### WHAT IS CLAIMED IS:

1. A laser nozzle for laser powder fusion welding, comprising:

2 an inner tip that resists damage arising from heat generated during a welding process;

4 an outer nozzle circumscribing the inner tip and spaced apart there from to define a powder flow channel there between; and

6 a housing circumscribing the outer nozzle in spaced apart relationship to define a circumscribing shield gas flow channel about the outer nozzle.

2. A laser nozzle for laser powder fusion welding as set forth in Claim 1, further comprising:

4 a main body coupling the inner tip, the outer nozzle and the housing, the main body defining a central passage through which light may travel, the main body defining a powder flow conduit in communication with the powder flow channel, 6 the main body defining a coolant channel coaxial with the central passage.

3. A laser nozzle for laser powder fusion welding as set forth in Claim 2, further comprising:

4 a water jacket cover coupled to the main body and enclosing the coolant channel to prevent coolant leakage, the water jacket cover defining a powder tube depression through which a powder tube may pass and communicate with the 6 powder flow conduit.

2. A laser nozzle for laser powder fusion welding as set forth in Claim 2, further comprising:

4 a porous shielding cover coupled to and circumscribing the outer nozzle, the porous shielding cover allowing gas to exit from the shield gas flow channel and preventing entry of material into the shield gas flow channel, the porous shielding 6 cover circumscribed by and coupled to the housing.

5. A laser nozzle for laser powder fusion welding, comprising:

2 a detachable inner tip that resists damage arising from heat generated during a welding process;

4 a detachable outer nozzle circumscribing the inner tip in spaced apart  
relationship to define a circumscribing powder flow channel about the inner tip;

6 a detachable housing circumscribing the outer nozzle in spaced apart  
relationship to define a circumscribing shield gas flow channel about the outer  
8 nozzle;

10 a main body coupling the inner tip, the outer nozzle and the housing, the main  
body defining a central passage through which light may travel, the main body  
defining a powder flow conduit in communication with the powder flow channel,  
12 the main body defining a coolant channel coaxial with the central passage;

14 a detachable water jacket cover coupled to the main body and enclosing the  
coolant channel to prevent coolant leakage, the water jacket cover defining a  
16 powder tube depression through which a powder tube may pass and communicate  
with the powder flow conduit; and

18 a detachable porous shielding cover coupled to and circumscribing the outer  
nozzle, the porous shielding cover allowing gas to exit from the shield gas flow  
channel and preventing entry of material into the shield gas flow channel, the  
20 porous shielding cover circumscribed by and coupled to the housing.

6. A coaxial nozzle for laser powder fusion (LPF) welding, comprising:

2 a main body defining a central light passage through which light may pass  
through the main body, the main body defining a powder conduit through which  
4 powder may pass through the main body, the main body defining a coolant channel  
through which coolant may flow, the coolant channel coaxial with the central light  
6 passage and circumscribing the powder conduit;

8 a coolant jacket cover detachably attached to the main body and sealing the  
coolant channel, the coolant jacket defining an inlet and an outlet to the coolant  
channel;

10 an inner tip defining a first central open channel through which light may  
pass, the inner tip detachably attached to a terminal end of the main body, the inner  
12 tip coaxial with the central light passage of the main body;

14 an outer nozzle defining a second central open channel through which powder  
may pass, the outer nozzle detachably attached to the main body, the outer nozzle  
16 coaxial with the first central open channel of the inner tip and the central light  
passage of the main body, a powder flow channel defined between the outer nozzle

and the inner tip in communication with the powder conduit;

18 an housing defining a third central open channel through which fluid may  
20 pass, the housing detachably attached to the main body, the housing coaxial with  
22 the second central open channel and the first central open channel and the central  
light passage, a shield gas flow channel defined between the outer nozzle and the  
housing; and

24 a detachable porous shielding cover circumscribing a terminal end of the outer  
nozzle and covering an open end of the shield gas flow channel.

7. A nozzle laser powder fusion welding, comprising:

2 a detachable and wear-resistant tip that resists damage arising from heat  
generated during operation, the tip having a first central light passage;

4 the nozzle defining a second central light passage aligned and communicating  
with the first central light passage;

6 the nozzle defining a powder flow passage circumscribing and coaxial with  
the central light passage;

8 the nozzle defining a shield gas flow passage circumscribing and coaxial with  
the powder flow passage and the central light passage; and

10 a detachable porous shielding cover covering an open end of the shield gas  
flow passage proximate the tip.

8. A nozzle for laser powder fusion welding as set forth in Claim 7, further comprising:

2 a main body defining the second central light passage;

4 the main body defining a powder conduit in communication with the powder  
flow passage;

6 the main body defining a coolant channel at a top end thereof; and

8 a coolant jacket cover detachably attached to the top of the main body and  
sealing the coolant channel, the coolant jacket defining a coolant inlet and a coolant  
outlet.

9. A nozzle for laser powder fusion welding as set forth in Claim 7, further comprising:

2 an outer nozzle detachably attached to the nozzle, the outer nozzle separating  
4 the powder flow passage from the shield gas flow passage, the outer nozzle  
directing powder flow to a focus point in front of the first central light passage.